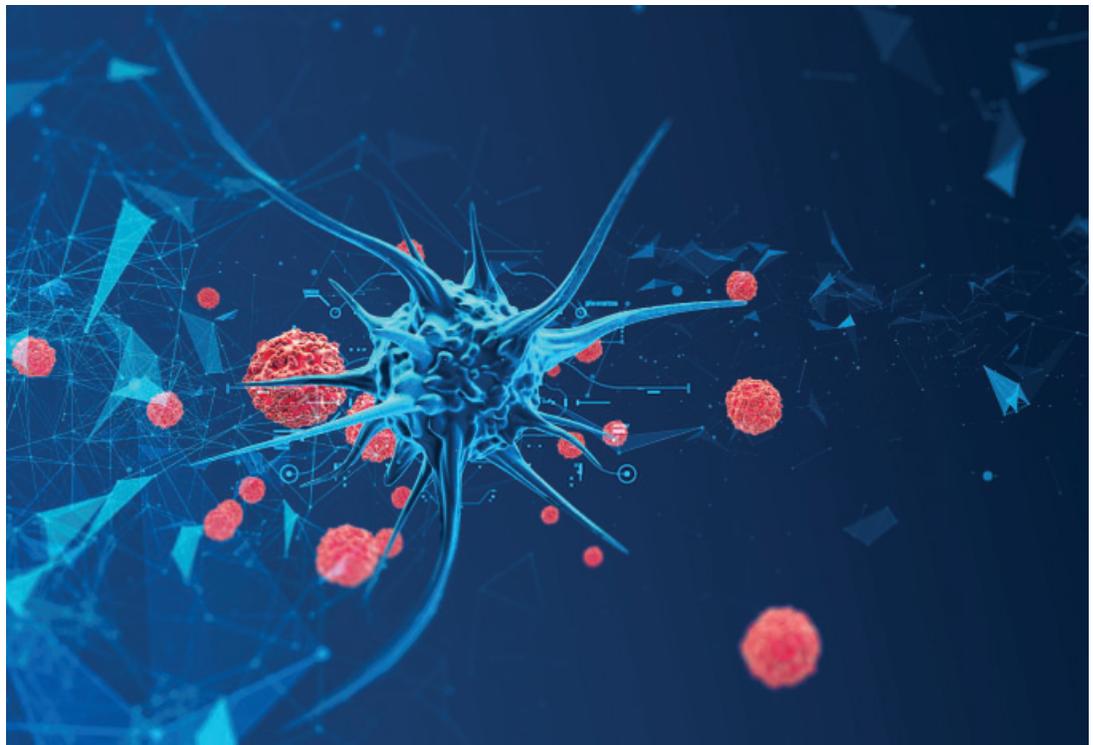


Infection, Immunology, and Sanitation



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Objective Sheet

SPECIFIC OBJECTIVES

After completing this module, you should be able to:

1. Define the term **infection**.
2. Complete statements that describe the effects of infection on a human host.
3. Complete statements that describe methods used to reduce the spread of infection.
4. Match types of infections and diseases to their descriptions.
5. Describe the phases in the course of a disease.
6. Complete statements that describe the role of the body's portals of entry and portals of exit in the spread of infectious diseases.
7. List sources of the microorganisms that cause infectious diseases.
8. Select the factors that determine whether a pathogen will cause a disease in a host's body.
9. Describe the factors that influence the virulence of a pathogen in a host's body.
10. Complete statements concerning the functions of the body's physical barriers to infection.
11. Match special structures, chemicals, and actions within the body that provide protection against infection to their functions.
12. Define the term **immunology**.
13. Select true statements concerning types of immunity.
14. Distinguish among the types of cellular and tissue defense-mechanism processes the body uses against disease and infection.
15. Match types of white blood cells to their descriptions.
16. Describe the stages of the interferon response.
17. Complete statements concerning the stages of phagocytosis.
18. Distinguish between the definitions of a T cell and a B cell.
19. Match types of T cells and B cells to their functions.
20. Distinguish between the types of immunity development in the serum-protein response.
21. Select true statements concerning the stages of cell-mediated immunity development in the serum-protein response.

22. Describe the stages of humoral-mediated immunity development in the serum-protein response.
23. Distinguish among the phases of the antibody-production cycle that follows the body's exposure to an antigen.
24. Describe the stages of the inflammatory reaction.
25. Match types of vaccines to their definitions.
26. Define the term **hypersensitive response**.
27. Distinguish among the types of hypersensitive responses.
28. Match methods used to control the spread of microorganisms to their definitions.
29. Explain the reasons certain industries must control the growth of microorganisms.
30. Select true statements concerning the factors that determine the effectiveness of an antimicrobial procedure.
31. Match types of antimicrobial-control methods to their descriptions.
32. List factors that contribute to the spread of nosocomial infections.
33. Match organisms that cause common nosocomial infections to the infections they cause.
34. Select true statements concerning types of patient isolation used in health-care facilities.
35. Complete statements that describe recommended precautions and guidelines used in surgical suites to reduce the spread of infection.
36. Conduct a sanitation inspection of the lab and classroom. (Assignment Sheet 1)
37. Practice critical thinking: complete a case study on immunity and infection. (Assignment Sheet 2)



Information Sheet

OBJECTIVE 1

The term infection

KEY TERMS

Disease (diz-ez')—A specific illness or disorder characterized by a recognizable set of signs and symptoms and attributable to heredity, infection, diet, or environment

Host (host')—An organism that serves as a permanent or temporary home for another organism

Toxin (tawk'-suhn)—A substance that is harmful to cells

Infection (in-fek'-shuhn)—An invasion of a body by organisms and the reaction of the body to the presence of those organisms and to the **toxins** that they produce; the presence and multiplication of an organism that results in harm or **disease** to a **host**

- ✓ **Note:** Very small organisms—referred to as **microorganisms** (mi-kro-or'-guh-niz-uhm)—can enter the body during respiration, ingestion, and sexual contact; through wounds; and by other conditions that provide openings into the body (see Objective 6).

OBJECTIVE 2

Effects of infection on a human host

KEY TERMS

Pathogen (path'-uh-juhn)—An organism that is capable of producing disease in another organism

Symptom (sim{p}'-tuhm)—A condition that occurs in association with a disease and that can be evidence of the presence of the disease

Examples: Fever, chills, sluggishness, rash, loss of appetite, watery eyes

- a. The harmful effects of an infection on a host may be the direct result of an action taken by a **pathogen** or the result of toxins produced by the pathogen.
 - ✓ **Note:** An infecting organism generally causes illness by disrupting the normal activities of a host's cells and, thus, organs.
- b. The ability of an infecting organism to harm a host is referred to as **virulence** (vir'-{y} uh-luhns).
 - ✓ **Note:** An infecting organism's virulence depends on a number of factors, such as how the organism enters the body, the number of invading pathogens, and other conditions. You will study these factors in Objective 9.

- c. The ability of a host to avoid infection and reduce harm caused by an infecting organism is called **resistance** (ri-zis'-tuhns).
- ✓ **Note:** The resistance of a host depends on a number of factors, such as general health, age, sensitivity to the pathogen, and other factors. You will study these factors in Objectives 8 and 9.
- d. An infection may result in observable **symptoms** in a host, or the infection may occur without symptoms.
- e. The period of time between the incidence of infection and the appearance of symptoms in a host is referred to as the **incubation** (in-kyuh-ba'-shuhn) **period**.
- f. An infection in a host may be localized, limited to only one organ or site, or it may be systemic, affecting the entire body.
- g. The host's body produces special cells that recognize pathogens and destroy them.
- ✓ **Note:** You will study these cells and their responses in later objectives in this module.
- h. Communicable (kuh-myu'-ni-kuh-buhl) diseases are infections that can be spread from one human host to another through direct or indirect contact.
- ✓ **Note:** You will study ways to prevent the spread of infection in Objective 3 and in later objectives in this module.

OBJECTIVE 3

Methods used to reduce the spread of infection

KEY TERMS

Antibiotic (ant-i-bi-awt'-ik)—A special medication that slows or stops the growth of certain microorganisms

Antiseptic (ant-uh-sep'-tik)—A chemical used to destroy or reduce the growth of pathogens on a person

Disinfectant (dis-uhn-fek'-tuhnt)—A chemical used to destroy or reduce the growth of pathogens on objects

Sterilize (ster'-uh-liz)—To destroy all of the pathogens on an object or in a substance

Vaccination (vak-suh-na'-shuhn)—The administration of a medication that increases the body's resistance to a specific pathogen

- a. The spread of infection can be reduced by using **antiseptic** practices, cleaning with **disinfectants**, and **sterilizing** instruments and surgical materials.
- b. Some infections can be prevented through **vaccinations**.
- c. Once an infection has occurred, **antibiotics** can be used to improve the body's ability to fight the infection.

OBJECTIVE 4**Types of infections and diseases**

- a. Localized infection—An infection that involves only one organ or site of a host's body
 - ✓ **Note:** A localized infection may also be referred to as a **local infection**.
 - b. Systemic infection—An infection that has spread throughout a host's body from an initial site
 - c. Acute (uh-kyut') infection—An infection that runs a rapid and severe course and then ends abruptly
 - Examples: Cold, measles, influenza
 - d. Chronic (krawn'-ik) infection—An infection that lasts for a long period of time—from weeks to several years
 - Examples: Advanced tuberculosis, acquired immunodeficiency syndrome (AIDS)
 - e. Latent (lat'-uhnt) infection—An infection that has no apparent symptoms
 - Examples: Malaria, early tuberculosis
 - f. Mixed infection—An infection that results from more than one organism
 - Examples: Appendicitis, wound infections
 - g. Nosocomial (nos-uh-ko'-me-uhl) infection—An infection that is contracted in a hospital or other health-care facility, such as a nursing home
 - ✓ **Note:** Caregivers can come into contact with diseases that infect the persons to whom they provide care. The infectious contamination can result from direct contact with the patient or client, through handling their body fluids (blood, urine, stools, saliva, mucus, etc.), or by touching objects that have been contaminated through contact with the patient, including clothing, bedding, bandages, dishes, and such. The caregiver may become infected or may transfer the infection to other caregivers or to patients or clients. Nosocomial infections often result from poor health-care practices.
 - h. Primary disease—The first-occurring infection within a period of illness
 - i. Secondary disease—A subsequent infection or complication to an existing condition
 - ✓ **Note:** An illness may lower a person's resistance to fight other infections, allowing other organisms to become established. For example, patients who are confined to a bed for a long period of time are more likely to contract pneumonia, an inflammation of the lungs that may result from infections by microorganisms.
-

OBJECTIVE 5

Phases in the course of a disease

KEY TERM

Convalescence (kawn-vuh-les'-uhns)—The process of a host's recovery from a disease

- a. Incubation—The period of time between the incidence of an infection and the appearance of symptoms in a host
- b. Illness—The period of time during which a host exhibits symptoms of a disease
 - ✓ **Note:** Some authorities divide the illness phase into two phases called the **prodromal** (pro-dro'-muhl) **phase** and the **acute phase**. The prodromal phase is a short period—usually less than a day—during which time the infection has been established but symptoms are not fully developed. The host may not feel well, but symptoms such as nausea and fever that are to follow are not yet evident. The acute phase is the time during which the symptoms are pronounced.
- c. **Convalescence** or death—The resolution of a disease, resulting in a host's recovery or death
 - ✓ **Note:** Most illnesses are called **self-limiting**—the body's defenses will overcome the illness in a short time, or the disease is caused by a pathogen that has only a short life cycle within the body. Some illnesses require the use of medications to assure recovery. In some cases, a host does not recover quickly, and some diseases can lead to the host's death. If the disease is not fatal—it does not lead to the host's death—the host may remain afflicted, with the disease becoming chronic. Often chronic illnesses do not lead directly to death, but they may allow secondary infections that can lead to death or that are fatal to the host because of his or her weakened condition from dealing with the chronic condition.



KEY TERMS

Asymptomatic (a-sim{p}-tuh-mat´-ik)—Being without symptoms

Carrier (kar´-e-uhr)—An organism capable of spreading disease

✓ **Note:** A carrier may exhibit symptoms of the disease or may be asymptomatic.

Contagious (kuhn-ta´-juhs)—Communicable, such as a disease that may be transmitted by direct or indirect contact

Genitourinary (jen-uh-to-yur´-uh-ner-e)—Referring to the structures and processes associated with urinary functions and reproduction

Lesion (le´-zhuhn)—A separation in tissue

✓ **Note:** A lesion may be the result of a mechanical injury such as a cut or surgical incision, or it may be the result of an infection that causes the flesh to tear.

Sputum (sp{y}ut´-uhm)—Substance expelled from the respiratory tract that may contain mucus, pus, cellular materials, blood, and other materials

Zoonosis (zo-uh-no´-suhs)—A disease of animals that is transmissible to humans from its primary animal host

Examples: Equine encephalitis, rabies, and yellow fever

- ✓ **Note:** Infections enter the body through openings called **portals of entry**. A portal of entry may be a natural opening, such as the mouth, or an injury, such as a cut. Infections can be communicated to others through openings called **portals of exit**. For example, when a **contagious** person sneezes, pathogens can exit with the mucus and droplets expelled from the nose.
- The most-common portals of entry for pathogens are breaks in the skin and natural body openings such as the nose, mouth, and **genitourinary** openings.
 - The most-common portals of exit for pathogens are skin **lesions** and natural body openings such as the nose, mouth, and genitourinary openings.

✓ **Note:** Pathogens are spread by persons coming into contact with the body fluids that leave by means of an infected person's portals of exit. Blood may be transferred from an open wound or by infected needles and instruments. Fecal material and urine can carry pathogens. **Sputum** and saliva carry pathogens from the lungs and mouth. Tears can transmit infections of the eyes. Semen and vaginal secretions can spread pathogens through sexual contact. Breast milk can transmit diseases from a woman to a nursing infant. Other fluids may also contain pathogens that can infect a second person if contact with a portal of entry occurs.
 - Typically, a disease will spread from an infected host's portals of exit to a second host's portals of entry.
 - Hosts who have recovered from a disease or who are **asymptomatic** may be **carriers** and transmit the disease to others.

- e. **Zoonosis** is spread to humans from animals.
- f. Pathogens that live in the soil, on other surfaces, or in contaminated foods can also enter the body through portals of entry.

OBJECTIVE 7

Sources of the microorganisms that cause infectious diseases

KEY TERMS

Fomite (fo'-mit)—An inanimate object that is contaminated with pathogens and is capable of transmitting pathogens to a human host

Inanimate (in-an'-uh-muht)—Nonliving

- a. Living hosts
 - ✓ **Note:** Living hosts can transmit a pathogen from itself to another host.
- b. **Inanimate** objects or materials

Examples: Transmission of a pathogen by a host's consuming contaminated food or water or contacting **fomites** such as contaminated drinking cups and eating utensils

OBJECTIVE 8

Factors that determine whether a pathogen will cause a disease in a host's body

KEY TERMS

Antibody (ant'-i-bawd-e)—A specialized protein produced in the blood plasma in response to bacteria, viruses, or other antigenic substances

✓ **Note:** Antibodies respond to specific structures on the outside of cells that indicate the cell's source. Cells within each host's body are marked as "self" cells by these structures or as antigens (ant'-i-juhns). The antigens of an invasive cell show that it is not part of the self. Upon detecting the antigen of a pathogen, the body will create an antibody that matches the antigen of the invasive organism. The antibody will then bond to the foreign antigen and remove it from the body.

Bacteriocidin (bak-tir'-e-o-si-din)—A medication that kills bacteria

✓ **Note:** While bacteria are a specific type of microorganism, the term **bacteria** is sometimes applied in a general way to any microscopic pathogen.

Phagocyte (fag'-uh-site)—A cell within the body that destroys invading organisms by engulfing and surrounding them

✓ **Note:** Phagocytes often seek out cells to which antibodies have attached.

- a. Site of the pathogen invasion
 - ✓ **Note:** The portal of entry of the pathogens and the site where the pathogens settle inside the body may determine whether the pathogens will cause illness. Some organisms are only infectious if they enter by a given portal of entry. For example, a host's swallowing the pathogens for malaria will not lead to infection because malarial organisms can only flourish if they enter through the bloodstream. Other organisms must reach a certain site within the body in order to survive.

b. Antibacterial techniques

- ✓ **Note:** Steps can be taken to reduce the risk of infection through antibacterial techniques. For example, if a person suffers a slight cut while using a knife, the wound should be washed and treated with an antibiotic. The wound may also be dressed—cleaned, medicated, and covered—to protect it and to prevent dirt and other contaminants from entering it.

c. Normal flora

- ✓ **Note:** The resident flora in and on the surface of our bodies offer some protection against infections because they are likely to be competitors with an invading pathogen. In many cases, the presence of normal flora will prevent the transient organism from becoming established. However, surgery or medications may reduce the population of resident flora, allowing the pathogens to spread, as when yeast infections occur as a result of the administration of antibiotics that reduce the population of resident flora on the skin.

d. **Bacteriocidins**

e. **Antibodies**

f. **Phagocytes**

OBJECTIVE 9

Factors that influence the virulence of a pathogen in a host's body

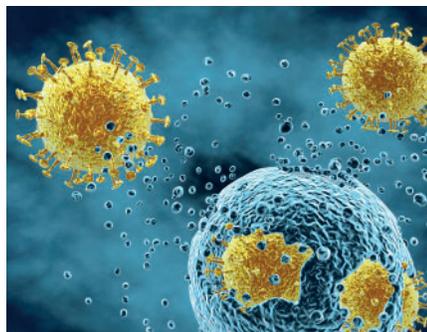
KEY TERMS

Immunity (im-yu'-nuht-e)—The state of being protected from the effects of a pathogen, generally due to having received a vaccination or because of the body's production of antibodies from a previous exposure to the organism

Susceptibility (suh-sep-tuh-bil'-uht-e)—The degree to which a person is likely to contract a disease

a. Ability to infect—The capacity of an organism to cause disease despite a host's resistance

- ✓ **Note:** Some organisms are generally very effective in their ability to cause an infection despite the host's health and resistance. For example, if a person has not developed **immunity**, exposure to the measles virus will normally result in an 80 to 90 percent infection rate, even among healthy individuals. By contrast, the rhinovirus that causes the common cold is not very effective against persons who are healthy, rested, and well nourished.



- b. Invasiveness (in-va'-siv-nes)—The level of success an organism experiences upon entering a host; a measure of the number of organisms that are able to enter a host's body
- ✓ **Note:** Invasiveness is tremendously influential in determining whether an infection occurs and how severe it is. Thus, a person who is present when an infected person sneezes across the room will be exposed to the pathogens, but the number of organisms that reach that person will be much lower than those that reach someone standing close to the infected person. If an organism gains entry through the mouth, it may not be as infectious as if it had entered through broken skin.
- c. Toxigenicity (tawk-si-juh-nis'-uht-e)—The relative strength and the amount of toxins produced by an organism
- ✓ **Note:** The effects of most pathogens come from their disruption of normal cell processes. In most instances, these disruptions are caused by toxins that the pathogen produces, such as enzymes, hemolysis, coagulase, endotoxins, and exotoxins. The pathogen's toxigenicity affects its virulence, especially when considered in terms of the infected person's **susceptibility** to the toxins.

OBJECTIVE 10

Functions of the body's physical barriers to infection

KEY TERM

Cerumen (suh-ru'-muhn)—Ear wax, a secretion of the ceruminous glands in the ear canal

- a. Perspiration—Helps to cleanse the pores and raise the level of acidity on the skin
- b. Tears—Rid the eyes of contaminants and help to seal and lubricate the eyelids to prevent entry of organisms
- c. Saliva—Contains enzymes that help break down invading pathogens and prevent them from colonizing in the mouth
- d. Vaginal secretions—Maintain a slightly acidic environment to prevent microorganisms from becoming established
- e. Mucus—Provides a coating that prevents pathogens from making direct contact with the skin
- f. **Cerumen**—Provides a coating that prevents pathogens from contacting delicate areas of the skin in the ear canal
- g. Normal flora—Compete with invading microorganisms to prevent them from becoming established

OBJECTIVE 11**Functions of the special structures, chemicals, and actions within the body that provide protection against infection**

KEY TERMS

Lysozyme (li'-suh-zim)—An enzyme with antiseptic actions that destroys some foreign organisms

Protective reflex (pruh-tek'-tiv re'-fleks)—Coughing, sneezing, vomiting, tearing of the eyes, or other action that provides protection against pathogens

- a. Ciliated membranes—Present physical barriers to contaminated particles and help to hold mucus in place
- b. **Lysozymes**—Inhibit the growth of bacteria in tears and saliva
- c. Digestive fluids—Inhibit the growth of bacteria in the stomach and intestines
- d. Normal flora—Compete with invading pathogens
- e. Flushing actions—Remove pathogens through the movement of liquids
Example: Respiration
- f. **Protective reflexes**—Generally expel contaminated substances from the body

OBJECTIVE 12**The term immunology**

Immunology—The study of the ways in which the body resists infection

OBJECTIVE 13**Types of immunity**

KEY TERMS

Immune serum (im-yun' sir'-uhm)—A serum that is taken from another organism (animal or human) and that contains antibodies against a specific disease

Vaccine (vak'-sen)—A suspension of diluted or killed microorganisms administered in order to stimulate the production of antibodies to promote an active immunity to that pathogen

✓ **Note:** Vaccines may be injected into the bloodstream; however, vaccines that use other portals of entry, such as ingestion, have been developed.

- a. Genetic immunity—Immunity based on one's inherited genetic makeup rather than on the production of antibodies

✓ **Note:** Essentially, the term **genetic immunity** means that an organism is not susceptible to a given pathogen that may invade it. Genetic immunity may appear in a racial group, within families, or apparently at random in certain individuals. Such immunity may also be species specific—some species of organisms are immune to infection by a pathogen while other species of organisms are susceptible.

- b. Naturally acquired active immunity—Long-term immunity acquired when a person contracts a disease and his or her body naturally produces antibodies in response to the pathogen and memory cells that protect that person from the pathogen
 - ✓ **Note:** A naturally acquired active immunity may protect a person from a pathogen for many years or even for the rest of the person's life.
- c. Artificially acquired active immunity—Long-term immunity acquired when a person is given a **vaccine** and his or her body produces antibodies in response to the vaccine and memory cells that protect that person from the pathogen
 - ✓ **Note:** Booster vaccinations may be required to provide an individual with lifelong immunity from the pathogen.
- d. Naturally acquired passive immunity—Temporary immunity acquired when antibodies are passed to a fetus through the mother's blood or to an infant through the mother's milk when the infant is breast-feeding
- e. Artificially acquired passive immunity—Temporary immunity acquired when an **immune serum** is injected into a person's bloodstream
 - ✓ **Note:** An immune serum does not contain memory cells, thus, the immunity provided by the serum is temporary (passive).

OBJECTIVE 14

Types of cellular and tissue defense-mechanism processes the body uses against disease and infection

- ✓ **Note:** We tend to think of diseases as affecting a person. In truth, the actual invasion that leads to diseases generally occurs at the cell level. There are several ways in which the cell and the body can fight back. First, the cell may release a chemical called **interferon** that interferes with the metabolism of the invading pathogen. The body can fight the infection by activating white blood cells that attack the pathogen individually or in combination with each other. At the tissue level, the body may exhibit an inflammatory reaction that involves physical and chemical responses that make it more difficult for an infection to spread. In this objective, you will learn general definitions for these four defense-mechanism processes. Subsequent objectives cover these defense mechanisms in more detail.
- a. Interferon (int-uh-fir'-awn) response—The process by which a cell releases chemicals that interfere with a virus' ability to reproduce within a cell
 - ✓ **Note:** In order to reproduce, viruses must be inside cells. However, the virus cannot multiply and spread if it does not reproduce. While interferon does not prevent the infection of that particular cell, it does prevent the virus from reproducing viruses that could spread to other cells. Artificial interferon is used to fight cancer because of this effect.

- b. Phagocytosis (fag-uh-suh-to'-suhz)—The process in which a moving cell engulfs a mass of foreign material
 - ✓ **Note:** Blood consists of three major types of cells: red blood cells, white blood cells, and platelets. These will be discussed in detail in the circulatory-system modules in Module Set II. However, white blood cells play an important role in the body's defense mechanisms and need to be covered here (see Objective 15). For example, one function of certain white blood cells is to clean up dead cells and other debris of metabolism. They perform this function by surrounding the debris through phagocytosis. White blood cells can also perform phagocytosis on invading pathogens as a defense mechanism.
- c. Serum-protein response—The process by which components of the blood and lymph analyze captured pathogens to help develop immunity reactions to the pathogens
 - ✓ **Note:** Serum proteins are components of blood and lymph. There are two types of serum-protein responses related to immunity. These are explained further in Objective 20.
- d. Inflammatory reaction (inflammatory response)—The process by which tissues in an area of injury or infection work to trap pathogens in the area
 - ✓ **Note:** The interferon response, phagocytosis, and the inflammatory reaction are all intended to provide a defense against a present, immediate pathogen threat. The serum-protein responses provide immediate defense, but they also help to improve the body's immunity as a defense against future invasions of that pathogen (resistance).

OBJECTIVE 15

Types of white blood cells

KEY TERMS

Heparin (hep'-uh-ruhn)—A chemical that helps prevent abnormal blood clotting

Histamine (his'-tuh-men)—A chemical that makes capillaries more permeable

- ✓ **Note:** Five types of white blood cells are described below. Each type of white blood cell or leukocyte (lu'-kuh-site) plays a role in one or more of the cell and tissue defense mechanisms. Additionally, for each type of white blood cell, there are variations that serve specific purposes in the body's response to pathogen invasion.
 - a. Neutrophil (nu'-truh-fil)—A type of white blood cell that is the first to respond to an inflammatory reaction, where it performs phagocytosis on pathogens
 - ✓ **Note:** Neutrophils make up approximately 55 to 70 percent of the white blood cells. Neutrophils provide a quick response that is not as organized and specific as subsequent reactions. Basically, they charge into the infected site and begin attacking foreign materials.
 - b. Lymphocyte (lim'-fuh-site)—One of two types of white blood cells—a T cell or a B cell—that performs various functions related to recognizing, marking, and remembering pathogens based on their antigens
 - ✓ **Note:** Approximately 20 to 35 percent of the white blood cells are lymphocytes. The two

major types of lymphocytes—T cells and B cells—are discussed in more detail in Objective 18.

- c. Monocyte (mawn´-uh-site)—A type of white blood cell that enlarges to form a macrophage (mak´-ruh-faj) in order to perform more-rapid phagocytosis
- ✓ **Note:** Monocytes compose 3 to 8 percent of all white blood cells. Many specialized macrophages are found throughout the body, where they often are named for the structures with which they are associated. For example, macrophages in the lungs are referred to as **alveolar macrophages**, those in the brain are called **brain microglia**, and those in the liver are **Kupffer cells**. In addition to attacking pathogens, macrophages engulf and dispose of dead and damaged tissue. This function supports the inflammatory response and aids in tissue repair.
- d. Eosinophil (e-uh-sin´-uh-fil)—A type of white blood cell that is believed to neutralize toxins such as those secreted by some pathogens
- ✓ **Note:** Eosinophils make up 1 to 3 percent of the body's white blood cells. In their detoxification role, they are also important in dealing with allergic reactions.
- e. Basophil (ba´-suh-fil)—A type of white blood cell that, as part of the inflammatory reaction, releases chemicals that allow the capillaries to be penetrated by white blood cells and other substances that accumulate at an infection site
- ✓ **Note:** Basophils represent less than 1 percent of the total number of white blood cells. They contain granules of **heparin** and **histamine**.

OBJECTIVE 16

Stages of the interferon response

KEY TERM

Fibroblast (fib´-ruh-blast)—A flat, elongated cell in the connective tissue

- a. Invasion—The virus enters the cell.
- b. Synthesis—The infected cell produces interferon.
- ✓ **Note:** The presence of the virus stimulates interferon production. Not all cells have the ability to produce interferon, which is simply a protein that cells synthesize. However, **fibroblasts**, which are involved in healing, and many types of leukocytes are especially efficient in interferon production.
- c. Release—The infected cell releases interferon into the bloodstream.
- ✓ **Note:** The presence of interferon in the bloodstream may be an additional defense against blood-transported pathogens and may serve as a signal for other defense mechanisms, such as the need for phagocytes.
- d. Interference—Interferon chemically attacks the virus and prevents it from multiplying.
- ✓ **Note:** Viruses are simply unicellular organisms that normally multiply by mitosis. Interferon prevents normal cell division from occurring in the virus. If the virus cannot divide, it will not be able to multiply and spread the infection. Interferon may be largely

responsible for the self-limiting nature of many infections.

- e. Phagocytosis—The infected cell and the inhabiting virus are engulfed by a phagocyte.
 - ✓ **Note:** Releasing interferon does not save the cell that has been invaded. That cell simply becomes a container for the trapped virus. The cell will die or will be perceived by phagocytes as damaged. The phagocytes will thus engulf and dispose of the cell and the virus.

OBJECTIVE 17

Stages of phagocytosis

KEY TERMS

Lysosome (li'-suh-som)—A particle that contains digestive enzymes and hydrogen peroxide that chemically dissolve an engulfed pathogen

Pseudopod (sud'-uh-pawd)—An extension of the surface of a phagocyte; a “false foot”

- a. Invagination (in-vaj-uh-na'-shuhn)—A phagocyte folds part of itself to create **pseudopods** that pull a pathogen to the body of the phagocyte.
 - ✓ **Note:** Several pseudopods may form in the surface of the phagocyte. The pseudopods extend toward the material that the phagocyte is going to engulf—the pathogen—wrap around it, and pull the material toward the body of the phagocyte.
- b. Engulfment—The pathogen is completely surrounded by the body of the phagocyte.
- c. Vacuole formation—The phagocyte creates a vacuole around the engulfed pathogen.
 - ✓ **Note:** The vacuole provides a sac in which the pathogen can be digested. The vacuole is called a **phagosome** (fa'-guh-som) and is moved toward the center of the phagocyte.
- d. Fusing—A **lysosome** fuses with the vacuole so that the contents of the lysosome are emptied into the vacuole containing the engulfed pathogen.
- e. Release—The phagocyte releases the contents of the vacuole or dies and then eventually decomposes.
 - ✓ **Note:** Phagocytes do not live very long and have essentially served their purpose when they have engulfed and digested invading pathogens or damaged cells and tissue. The accumulation of phagocytes and other debris is the main source of pus in an infection site.

OBJECTIVE 18

The terms T cell and B cell

KEY TERM

Marrow (mar'-o)—The inner structure of most large bones

OBJECTIVE 19

- a. T cell—Type of lymphocyte that is formed either in the fetal thymus gland or in the bone **marrow** and passes through the thymus on its way to the lymph nodes and spleen
- b. B cell—Type of lymphocyte that is formed in fetal bone marrow and moves directly to the lymph nodes and spleen

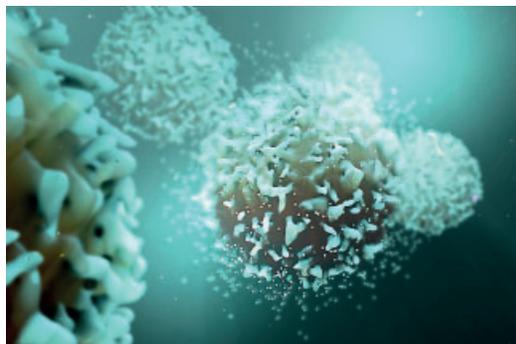
Types of T cells and B cells and their functions

KEY TERMS

Lysis (li'-suhz)—A process of disintegration or dissolution (as of cells)

Sensitized (sen'-suh-tizd)—Capable of being affected by a specific stimulus

- a. Helper T cells—Seek out phagocytes that have engulfed pathogens and examine the antigens of captured pathogens; may also present the foreign antigen to B cells
 - ✓ **Note:** Phagocytes present the antigens of a captured pathogen to helper T cells, which become **sensitized** to the pathogen.
- b. Sensitized helper T cells—Divide rapidly to produce memory, cytotoxic, and suppressor T cells
- c. Memory T cells—Carry the imprint of a particular pathogen's antigens and store the imprint in preparation for future invasions of the pathogen
- d. Cytotoxic (sit-uh-tawk'-sik) T cells—Chemically rupture the cell membrane of infected cells to prevent the pathogen from reproducing and also produce chemicals called **cytokines** (si'-to-kins) that attract phagocytes to the area where the pathogen is located
 - ✓ **Note:** Cytotoxic T cells are also referred to as **killer T cells**. The rupturing of the pathogen's cell membrane is referred to as **lysis**.
- e. Suppressor T cells—Suppress the immune response once a foreign antigen has been destroyed
- f. Inactive B cells—Reside in the liver, spleen, and lymph nodes until exposed to the antigen of their target pathogen
- g. Activated B cells—Divide into memory B cells and plasma cells
- h. Memory B cells—Remember the antigen and will become involved in responding to any subsequent invasion by that pathogen
- i. Plasma cells—Produce antibodies specific to a pathogen's antigen and tag the pathogen cells for destruction by phagocytes



OBJECTIVE 20**Types of immunity development in the serum-protein response****KEY TERM**

Humoral (hum´-uh-ruhl)—Referring to the old concept of the body having four basic humors or fluids, including the plasma in which humoral-immunity development takes place

- ✓ **Note:** As noted previously, immunity depends on the ability of the body's defense mechanisms to recognize invading pathogens. Such recognition may be nonspecific, such as when a phagocyte attacks any cell that it does not recognize as "self." On the other hand, immunity may be specific to a pathogen due to the body's ability to recognize the antigens of that pathogen. The body uses two processes to acquire this type of immunity as described in this objective.
 - a. Cell-mediated immunity—Relies on the ability of memory T cells to recognize a pathogen's antigen
 - b. **Humoral**-mediated immunity—Relies on the production of antibodies that will recognize subsequent invasions of a pathogen
 - ✓ **Note:** Because of the involvement of antibodies, this process is also referred to as **antibody-mediated immunity**.

OBJECTIVE 21**Stages of cell-mediated immunity development in the serum-protein response**

- a. Phagocyte location—T cells are released in a form called helper T cells to seek out phagocytes that have engulfed pathogens.
- b. Sensitization—The T cells become sensitized to the pathogen antigens in the phagocytes.
- c. Cloning—The sensitized helper T cells form other sensitized helper cells and memory, cytotoxic, and suppressor T cells.
- d. Pathogen binding—The cloned cells travel to the site of the infection and attach to the antigen of pathogen cells.
- e. Cytokine release—The cytotoxic T cells secrete cytokines to disrupt pathogen metabolism and to attract phagocytes to the area.
- f. Macrophage response—Macrophages migrate to the infection site and engulf pathogens and damaged cells.
- g. Suppression—Suppressor T cells secrete macrophage-inhibiting chemicals once the foreign antigen has been destroyed.

OBJECTIVE 22**Stages of humoral-mediated immunity development in the serum-protein response**

- a. Sensitization—Helper T cells present the pathogen antigen to B cells, which become sensitized to the antigen.
- b. Cloning—The B cells form memory B cells and plasma cells.
- c. Antibody production—The plasma cells produce antibodies specific to the pathogen's antigen and tag the pathogen cells for destruction by phagocytes.
- d. Macrophage response—Macrophages migrate to the infection site and engulf pathogens and damaged cells.
- e. Complement cascade—Enzymes in the plasma cause a chain of chemical reactions that result in the complement components rupturing pathogen cells and in other actions such as attracting neutrophils to the site.
 - ✓ **Note:** The plasma complement includes around 20 proteins that work together when activated to respond to a pathogen invasion. In some cases, the complement response can take place for nonspecific immunity without involving antibodies.

OBJECTIVE 23**Phases of the antibody-production cycle that follows the body's exposure to an antigen**

- ✓ **Note:** The following cycle occurs whether the initial infection occurs naturally or as a result of a vaccination.
- a. Lag phase—The phase during which the body detects an unrecognized foreign antigen and begins to react
 - ✓ **Note:** Generally, the body produces antibodies only after an exposure to an unrecognized foreign antigen. The body recognizes its own antigens and usually only attacks foreign antigens.
 - b. Primary-response phase—The phase during which the body produces (1) antibodies that “fit” the previously unrecognized antigen and (2) memory cells that will recognize that antigen during any subsequent exposure
 - ✓ **Note:** The number of antibodies produced during the primary-response phase is generally not enough to prevent an infection, so the person usually becomes sick. After the invading antigens are removed from the body following an illness, the number of antibodies in the bloodstream declines, but the memory cells remain.
 - c. Secondary-response phase—The phase during which the body is exposed to a subsequent invasion by an antigen, the memory cells immediately recognize the antigen, and the body produces antibodies against it
 - ✓ **Note:** If there is a second invasion by a foreign antigen, the body immediately recognizes the antigen and begins to produce antibodies based on the “memory” of the first infection. Consequently, in many cases, the body is able to produce enough antibodies in a short enough time to prevent the antigen from becoming established, and the person may not become sick.

OBJECTIVE 24**Stages of the inflammatory reaction**

KEY TERMS

Constrict (kuhn-strikt´)—To grow smaller or narrower

Dilate (di-lat´)—To grow larger or expand

- ✓ **Note:** The terms **dilate** and **constrict** have opposite meanings. Both terms are used often in anatomy and physiology. Blood vessels constrict and dilate, and so do the pupils of the eyes, as well as other body structures.

Exudate (ek´-shu-dat)—A substance that has oozed from a body, such as from a cell

- ✓ **Note:** As you learned in Objective 14, the inflammatory reaction is a set of responses made by the body at the site of an injury or infection to trap pathogens in a localized area. Inflammation and the inflammatory reaction are also discussed in Module 4 of this module set. This objective concentrates on the infection-fighting aspects of the inflammatory reaction.
 - Constriction—The blood vessels **constrict** to allow blood to pool at the affected site.
 - Dilation—The blood vessels **dilate**, and white blood cells gather in the affected site to fight infection.
 - Exudation—The injured or infected cells secrete **exudate** that causes the area to swell.
 - Barrier formation—The exudate creates a fibrous network that prevents pathogens from spreading from the area.

OBJECTIVE 25**Types of vaccines**

KEY TERMS

Attenuated (uh-ten´-yuh-wat-uhd)—Weakened or lessened in power or effect

Toxoid (tawk´-soid)—A toxin that has been modified so as not to be harmful

- ✓ **Note:** Vaccines are intended to provide protection against a specific pathogen. To produce the vaccine, an organism must serve as a source of antigens so that the body will make antibodies in response to the vaccination. The source organism may be the actual pathogen or one that is closely enough related to the target pathogen that the resulting vaccine will produce an antibody response in the vaccinated organism. The pathogen or related species may be living or killed, or a portion of the pathogen, such as bacterial capsules or toxins, may be used.
 - Nonpathogenic strain—A vaccine that contains organisms of the same genus as the target pathogen but that are a species of subspecies that is not pathogenic

Example: Some influenza vaccines
 - Closely related microorganism—A vaccine that contains nonpathogenic organisms that are

chemically similar to the target pathogen

Example: Early small-pox vaccinations that were based on the pathogen for cow pox

- c. **Attenuated** living pathogen—A vaccine that contains live weakened or less-virulent forms of the target pathogen

Examples: Live oral polio vaccine, live attenuated measles vaccine

- d. Killed pathogen—A vaccine that contains nonliving or inactivated pathogens

Examples: Vaccine for rabies, vaccine for typhoid fever

- e. Extract of pathogen—A vaccine that contains components of the pathogen, such as bacterial capsules

Examples: Pneumococcal polysaccharide vaccine, **Haemophilus b** conjugate vaccine

- f. **Toxoid**—A vaccine that contains toxins or toxoids of the pathogen

Examples: Vaccine for diphtheria, vaccine for tetanus

OBJECTIVE 26

The term hypersensitive response

Hypersensitive (hi-puhr-sen'-suht-iv) **response**—An excessive response by the body's immune system to a foreign substance

- ✓ **Note:** In some individuals, the hypersensitive response is so excessive that the body may disrupt normal cell functions to attack the foreign substance, even to lowering blood pressure to a fatal level in a condition called **anaphylactic shock** (an-uh-fuh-lak'-tik shawk'). Hypersensitive responses to relatively harmless substances—pollen, peanuts, insect venom, etc.—are called **allergic reactions** (uh-luhr'-jik re-ak'-shuhns), and the precipitating stimulus is referred to as an **allergen** (al'-uhr-juhn).

OBJECTIVE 27

Types of hypersensitive responses

KEY TERM

Congenital (kawn-jen'-uh-tuhl)—Present at birth as a result of conditions in the womb

- a. Immediate—Hypersensitive response upon exposure to an allergen and due to an antigen/antibody reaction
- b. Delayed—Hypersensitive response following exposure to an allergen and due to body cells reacting to the allergen
- c. Autoimmunity—Hypersensitive response to one's own antigens
- ✓ **Note:** Autoimmune disorders can be caused by a number of conditions and can lead to a number of illnesses, such as some forms of diabetes, arthritis, and multiple sclerosis.
- d. Isoimmunity—Hypersensitive response to antigens from one's own species
- ✓ **Note:** Isoimmunity is one of the principal reasons why a person's body rejects a transplanted organ or tissue and why a pregnant woman's body sometimes creates

antibodies that attack the antigens of her fetus, resulting in birth defects or **congenital** diseases in the fetus.

OBJECTIVE 28

Methods used to control the spread of microorganisms

- a. Antiseptic (ant-uh-sep'-tik)—A chemical used to destroy or reduce the growth of pathogens on people
- b. Disinfectant (dis-uhn-fek'-tuht)—A chemical used to destroy or reduce the growth of pathogens on objects
- c. Broad-spectrum antibiotic (brawd' spek'-truhm ant-i-bi-awt'-ik)—A chemical used to treat bacterial infections that may be caused by a wide variety of bacteria
- d. Narrow-spectrum antibiotic (nar'-o spek'-truhm ant-i-bi-awt'-ik)—A chemical used to treat infections caused by a specific kind of bacterium or a few kinds of bacteria
- e. Sterilization (ster-uh-luh-za'-shuhn)—A process that destroys pathogens on surfaces
- f. Pasteurization (pas-chuh-ruh-za'-shuhn)—A process of heating a food to destroy pathogens in the food

Example: Pasteurization of milk

OBJECTIVE 29

Reasons certain industries must control the growth of microorganisms

- a. Public health—To prevent the spread of illness
- b. Food preservation—To keep microorganisms from destroying food and to prevent the spread of disease through infected food
- c. Production of sterile products—To prevent contamination of the products during the production process
- d. Research—To produce pathogens under controlled circumstances to gain better understanding of them and to develop vaccines and other control measures for them



OBJECTIVE 30**Factors that determine the effectiveness of an antimicrobial procedure**

- a. Immediacy of initial treatment—The effectiveness of an antimicrobial procedure depends on how quickly the antimicrobial procedure was performed after the possibility of a microbial invasion.
- b. Interval between treatments—The effectiveness of an antimicrobial procedure depends on how much time has passed between the initial antimicrobial procedure and a subsequent procedure.
 - ✓ **Note:** Timing of treatments has a tremendous impact on the effectiveness of an antimicrobial procedure. Basically, such treatments are a race against the growth rate of the pathogen. If the initial treatment is delayed, the pathogen will have multiplied and gotten a head start over the effectiveness of the procedure. Similarly, if there are delays between treatments, those pathogens that survive an initial treatment will have time to multiply before the procedure is repeated.
- c. High temperature—The effectiveness of an antimicrobial procedure is increased if the procedure is performed under extremely high temperatures.
- d. Low temperature—The effectiveness of an antimicrobial procedure can be increased if the procedure is performed under extremely low temperatures.
 - ✓ **Note:** Extremely high temperatures and, in some cases, extremely low temperatures can kill microbes; however, warm temperatures can actually promote the spread of microorganisms.
- e. Concentration—The strength of the antimicrobial substance used in an antimicrobial procedure can increase the effectiveness of the procedure.
- f. Type of microbe—The effectiveness of an antimicrobial procedure is increased when the proper procedure is selected for the type of microbe it will be used against.
- g. Number of microbes—The effectiveness of an antimicrobial procedure is increased if the procedure is initiated before there are a great number of microbes to be killed.
- h. Microbial defense—The effectiveness of an antimicrobial procedure is increased if the microbe has not been overly exposed to the procedure and has developed defenses against the procedure.

OBJECTIVE 31**Types of antimicrobial-control methods**

- ✓ **Note:** Physical methods are those techniques that kill or remove pathogens using physical barriers or energy transported by various means. There is not a chemical reaction or poisoning of the pathogen.

Physical methods

- a. Barrier—Physical method used to prevent microbes from reaching portals of entry

Examples: Gloves, face shield

- b. Moist heat—Physical method used to kill microbes through the combined effect of heat and water that is at a temperature short of boiling
- c. Dry heat—Physical method used to kill microbes through the effects of heat from a source such as an oven or an infrared light
- d. Pressurized steam—Physical method used to kill all microbes and their spores through the effects of an autoclave
- e. Cold—Physical method that will not generally kill microbes but is used to slow their growth
- f. Drying—Physical method used to reduce the growth of fungi and some bacteria
- g. Radiation—Physical method used to kill microbes on materials such as plastics that cannot be subjected to high temperatures
- h. Ultrasonic waves—Physical method used to kill microbes on materials that can be safely exposed to microwaves
- i. Filtration—Physical method used to control microbes in a fluid (liquid or gas) by forcing the fluid through a material with openings that allow the fluid to pass through but are too small to allow pathogens to pass through, leaving pathogens trapped in the material

Chemical methods

- ✓ **Note:** Chemical control of microbes is generally achieved by lysis, damaging the pathogen's genetic material, or interfering with its metabolism, as by inactivating enzymes within the pathogen.
- a. Antiseptic—Chemical method used to destroy bacteria on living organisms
- b. Disinfectant—Chemical method used to destroy bacteria on inanimate objects
- c. Sterilant—Chemical method used to destroy all organisms on inanimate objects

OBJECTIVE 32

Factors that contribute to the spread of nosocomial infections

- a. Improper hand-washing techniques
- b. Inappropriate use of antibiotics
 - ✓ **Note:** Excessive use of antibiotics can cause the pathogens to become resistant to the effects of the medication. Antibiotics can also destroy resident flora, allowing other organisms to gain a competitive advantage.
- c. False sense of security
 - ✓ **Note:** Patients and caregivers are both likely to assume that the hospital and routine care techniques as well as the treatment being given are a means of protecting the patient from infections.
- d. Type of surgery performed on patient
 - ✓ **Note:** Some types of surgeries are more likely to lead to infections than others. Surgeries

involving the abdomen, especially the intestines, may expose other parts of the body to resident microbes that are normally nonpathogenic. Burns and other injuries that break the surface of the skin and make it difficult to close off portals of entry are more likely to become infected.

e. Caregiver's patient load

- ✓ **Note:** When caregivers have frequent contact with a number of patients, their risk of exposure is increased.

f. Type of care procedure performed

- ✓ **Note:** Procedures that require the handling of body fluids, soiled dressings and bedding, exposure of surgical incisions, and close contact with contagious patients increase the risk of nosocomial infections.

g. Facility staffing

- ✓ **Note:** The number of staff members, the quality of their training, how conscientious they are, and other personal factors can contribute to the spread of infections in a health-care facility.

h. Administration of an immunosuppressive agent

- ✓ **Note:** Immunosuppressive (im-yu-no-suh-pres'-iv) agents are given to patients who have had organ or tissue transplants to reduce the chances that the patient's immune system will attack the foreign cells. Persons receiving these agents are more likely to contract other infections because of their reduced defense mechanisms.

OBJECTIVE 33

Organisms that cause common nosocomial infections and the infections they cause

KEY TERM

Colitis (ko-lit'-uhs)—An inflammatory condition of the large intestine characterized by severe diarrhea, bleeding, and ulceration of the mucosa of the intestine

a. Staphylococcus aureus (staf-uh-lo-kawk'-uhs or '-e-uhs)—Responsible for a number of post-operative infections commonly referred to as **staph infections**

b. Streptococcus (strep-tuh-kawk'-uhs) species—Involved in "strep" throat, scarlet fever, pneumonia, rheumatic heart disease, and other communicable conditions

c. Esherichia coli (esh-er-ik'-i-uh ko'-li)—Responsible for various infections referred to as **colitis**

- ✓ **Note:** **E. coli** normally reside in the human intestinal tract with no ill effect; however, during surgical procedures, the microbes may be spread to other parts of the body where they can cause various infections. **E. coli** is one of the most-common sources of nosocomial infections.

d. Pseudomonas aeruginosa (sud-uh-mo'-nuhs uh-rug'-i-no-suh)—Presents a particular hazard for various infections to burn victims, patients with cystic fibrosis, and those patients with certain types of cancer where the skin and mucous membranes do not afford adequate

protection

- ✓ **Note:** *Pseudomonas aeruginosa* normally inhabits soil and water and is a transient flora for the intestines.
- e. Mycobacterium (mi-ko-bak-tir'-e-uhm) species—Responsible for tuberculosis and leprosy and present a particular hazard for various infections to patients with low resistance, such as those with acquired immunodeficiency syndrome (AIDS), to those receiving immunosuppressors, and to those with pulmonary conditions
 - ✓ **Note:** Some mycobacterium species are found in the lungs with no ill effects on the host.
- f. Human immunodeficiency virus (HIV)—Responsible for AIDS
 - ✓ **Note:** HIV is of particular concern to health-care workers because it can be spread through body fluids.
- g. Hepatitis (hep-uh-tit'-uhs) B virus—Responsible for hepatitis
 - ✓ **Note:** Hepatitis B virus is one of three common strains, though other strains exist. Hepatitis B is a significant threat in health care because it can be spread through body fluids.
- h. Human papilloma (hu'-muhn pap-uh-lo'-muh) virus—Associated with several types of cancer, including cancers of the mouth and cervix

OBJECTIVE 34

Types of patient isolation used in health-care facilities

KEY TERM

Enteric (en-ter'-ik)—Pertaining to the intestine

✓ **Note:** Enteric pathogens are present in feces and other alimentary-system wastes and can be spread in that way.

- ✓ **Note:** Over time, there have been many modifications to the recommended methods of patient isolation. The Hospital Infection Control Practices Advisory Committee (HICPAC) of the Centers for Disease Control recommends such guidelines. At the time of this writing, HICPAC recommended three types of transmission-based precautions for air-borne, droplet, and contact transmissions of infections. These special precautions are to be modified by hospitals for local use. The list below gives some common types of isolation that have been used over the years and some general guidelines. Health-care workers are responsible for knowing the specific requirements for their facilities. More information with regard to these practices is available on the National Institute of Health web site at <http://www.nih.gov>.
- a. Total—Isolation that requires a patient to have no contact with anyone
 - ✓ **Note:** Total isolation is also referred to as **strict isolation**.
- b. Protective—Isolation that requires that a patient not be exposed to infection risks

- c. **Enteric**—Isolation that requires protection with regard to a patient’s intake and output of food and liquids
- d. Wound and skin—Isolation that requires the use of barriers to prevent contact with moist areas
 - ✓ **Note:** Wound and skin isolation may also be called **drainage/secretion precautions**.
- e. Respiratory—Isolation that requires the use of a mask and separation of a patient from contact with other patients
 - ✓ **Note:** Other special requirements may be necessary for patients with tuberculosis.
- f. Blood/body fluids—Isolation that requires the use of gloves and other barriers and proper disposal of body fluids and contaminated materials
 - ✓ **Note:** This type of isolation is sometimes referred to as **body-substance isolation**.

OBJECTIVE 35

Recommended precautions and guidelines used in surgical suites to reduce the spread of infection

KEY TERMS

No-touch passing—Passing an object so that neither the person handing nor the person taking the object touches the object near a cutting edge

Sharps (sharps´)—Instruments such as scalpels, needles, tweezers, and other devices that are capable of separating flesh; also includes foreign bodies such as glass, metal fragments, splinters, knives, and other objects that may be removed from the body and then present hazards to health-care workers

Venipuncture (ven´-uh-puhn{k}-chuhr)—A procedure that involves puncturing a vein

- ✓ **Note:** Each facility will have its own set of procedures for reducing the spread of infection. The following guidelines are based on the standard precautions that the Centers for Disease Control (CDC) recommend whenever there is a chance of exposure to body-fluid-borne pathogens, including the human immunodeficiency virus (HIV).
 - a. Hands and other skin surfaces should be washed immediately and thoroughly if contaminated with blood or other body fluids.
 - b. Handling of body fluids and specimens should only be done while wearing goggles, masks, gloves, and impermeable clothing.
 - ✓ **Note:** The CDC recommends: “all health-care workers should routinely use appropriate barrier precautions to prevent skin and mucous-membrane exposure when contact with blood or other body fluids of any patient is anticipated. Gloves should be worn for touching blood and body fluids, mucous membranes, or non-intact skin of all patients, for handling items or surfaces soiled with blood or body fluids, and for performing **venipuncture** and other vascular-access procedures. Gloves should be changed after contact with each patient.”
 - c. Hands should be washed immediately after gloves are removed.
 - d. Used **sharps** should be placed in disposable containers, using **no-touch passing**.

- e. Used needles should not be recapped.
- ✓ **Note:** The CDC recommends: “all health-care workers should take precautions to prevent injuries caused by needles, scalpels, and other sharp instruments or devices during procedures; when cleaning used instruments; during disposal of used needles; and when handling sharp instruments after procedures. To prevent needlestick injuries, needles should not be recapped, purposely bent or broken by hand, removed from disposable syringes, or otherwise manipulated by hand.”
- f. Staples should be used instead of sutures whenever possible.
- ✓ **Note:** Staples present lower risk of accidental pricking of medical-staff members than does the use of a needle to sew sutures.
- g. After they are used, disposable syringes and needles, scalpel blades, and other sharp items should be placed in puncture-resistant containers for disposal.
- h. Reusable instruments and equipment should be subjected to a level of sterilization that will ensure terminal exposure for pathogens.
- i. Health-care workers who have sores or skin conditions that exude fluids should refrain from all direct patient care and from handling patient-care equipment until the condition resolves.
- ✓ **Note:** The CDC advises: “pregnant health-care workers are not known to be at greater risk of contracting HIV infection than health-care workers who are not pregnant; however, if a health-care worker develops HIV infection during pregnancy, the infant is at risk of infection resulting from perinatal transmission. Because of this risk, pregnant health-care workers should be especially familiar with and strictly adhere to precautions to minimize the risk of HIV transmission.”



OBJECTIVE 36

Assignment Sheet 1—Conduct a Sanitation Inspection of the Lab and Classroom

Name _____ Date _____

Evaluation criteria

Rating

- Conducted thorough inspection of the lab and classroom for cleanliness and sanitary conditions _____
- Grew and evaluated bacteria in Petri dishes _____
- Worked with partner to compile the report of findings _____
- Clearly and concisely presented observations and findings to class _____
- Teamwork demonstrated throughout completion of assignment _____

Overall rating _____

Evaluator's comments _____

EXERCISE

ACTIVITY CHECKLIST

Put an "X" on the blank line before each activity below as you complete it.

- _____ 1. Review the objectives in the Information Sheet.
- _____ 2. Complete Part 1.
- _____ 3. Complete Part 2 and report your observations and findings to the class.
- _____ 4. Complete the assignment sheet and give it to your instructor for evaluation.

PART 1 DIRECTIONS

Select a partner and begin inspection of the lab and classroom. Inspection should include but not limited to the following:

Yes or No

- Inspect the lab area
 - Liquid sanitizer is fresh and mixed to appropriate strength _____
 - Ultraviolet or other sanitizers are in good working condition and clean _____
 - Lab is clean and sanitary _____

- Take a swab for bacteria from the doorknobs to the classroom. Place in a Petri dish for bacteria culture growth. _____
- Take a swab for bacteria from the desks. Place in a Petri dish for bacteria culture growth. _____
- Take a swab for bacteria from the books. Place in a Petri dish for bacteria culture growth. _____
- Take a swab for bacteria from the bottom of your shoes. Place in a Petri dish for bacteria culture growth. _____
- Place a hair in a Petri dish for bacteria culture growth. _____
- Place your finger in a Petri dish for culture growth. _____
- Set the Petri dishes in a secure area. _____

PART 2
DIRECTIONS

Determine the growth in each Petri dish for five days. View bacteria cultures under a microscope. Develop a report of findings on observations and cultures taken with your partner. Be sure to take notes and be prepared to report your observations and findings to the class.

Assignment Sheet 2—Practice Critical Thinking: Complete a Case Study on Immunity and Infection

Name _____ Date _____

Evaluation criteria	Rating
• Directions were followed	_____
• Case-study presentation followed agreed-upon format	_____
• Case-study presentation met agreed-upon criteria	_____
	Overall rating _____

Evaluator's comments _____

INTRODUCTION

The main focus of this module has been on infection and how patients and health-care givers are protected against infections by their own bodies and by following wise precautions. In recent years, a great deal has been learned about the body's immune system and the control of infections. Much of this growing knowledge has been a result of the world's need to deal with AIDS. AIDS research has led to a number of discoveries about the immune system and about specific invasions of the body, such as cancer.

This assignment sheet contains four topic areas related to immunity and infection. Your instructor will ask you to research one of those topics.

EXERCISE

ACTIVITY CHECKLIST

Put an "X" on the blank line before each activity below and on the following page as you complete it.

- _____ 1. Review the objectives in the Information Sheet.
- _____ 2. Check with your instructor to determine which of the following four case studies you will complete. Write the number of that case study on the blank on the next page.
- _____ 3. Check with your instructor to determine the format (written report, Power Point presentation, poster, etc.) your instructor wants you to follow in completing your case study. Describe that format on the blank lines below.
- _____ 4. Check with your instructor to agree upon the evaluation criteria he or she will use to evaluate your case-study presentation. Describe those criteria on the blank lines below.

_____ 5. Complete your case study and return it to your instructor for evaluation.

Case-study number _____

Format of case-study presentation _____

Evaluation criteria for case-study presentation _____

CASE STUDY 1

Acquired immunodeficiency syndrome (AIDS) is the result of a virus that invades the body. One of the earliest indications of AIDS was the occurrence of two conditions that are rarely health issues. One was a cancer known as **Kaposi's carcinoma**. Before 1980, Kaposi's carcinoma was rarely seen and then only as a slow-growing tumor in elderly men. A number of patients were also contracting a particular type of pneumonia that is caused by the protozoan **Pneumocystis carini (P. carini)**. Humans normally have high resistance to this protozoan and rarely contract this form of pneumonia. Further, the occurrences of Kaposi's carcinoma and **P. carini** pneumonia seem to be limited to small populations, mostly young homosexual men and injection-drug users in California and New York. Based on these facts, what conclusions can you make regarding the nature of the condition, how it affects the body, and how it spreads? What would be the logical strategy for trying to boost the resistance of the affected population and trying to rid infected persons of the virus? Finally, what precautions would be logical for health-care givers who treat AIDS patients.

CASE STUDY 2

A common theory about cancer is that cancerous cells occur in our bodies quite often. According to the theory, however, these cells seldom get established as tumors because the body's immune system normally takes care of the cancerous cells. Unfortunately, there are occasional failures in the immune system that allow cancer cells to become established. At the turn of the last century, a physician named William B. Coley gave cancer patients mixtures of pathogens intended to give them fevers. Many of Coley's patients exhibited remission of their cancers—often at a higher recovery rate than other treatments. Today, some cancers are fought with cytokines such as interferon and interleukin. Much of today's cancer research involves the use of vaccines made from the patient's cancer cells. Based on this information and other facts that you may find, do you think that the immunity deficiency theory for cancer is valid? Why or why not? In keeping with your response, what do you think is the most likely avenue for finding a cure for cancer?

CASE STUDY 3

Recently, a number of pathogens, such as tuberculosis, no longer are affected by vaccines and other treatments. A number of antibiotics that were once effective against certain pathogens such as streptococcus have little impact. Based on what you learned about the factors that allow a pathogen to cause an infection, what do you think is the reason for this decreased efficiency in drugs and vaccines? How do you think the problem should be addressed?

CASE STUDY 4

During recent years, health facilities have made frequent changes in care procedures in order to deal with the increased incidence of AIDS, tuberculosis, and other conditions. Review the precautionary procedures used in your facility, a neighboring facility, or a fictional facility as provided by your instructor. Rate those procedures in how appropriate they are for the following types of patients. Be specific about what you think is proper and how some precautions should be changed.

- An HIV-positive woman delivering a baby
- A patient with chronic tuberculosis requiring surgery for internal injuries following a car accident
- A person with an unknown rash over his entire body who requires a tracheotomy because his throat has swollen shut
- An irrational patient with self-inflicted wounds that require surgical attention

Answers to Assignment Sheets

Assignment Sheet 1—Conduct a Sanitation Inspection of the Lab and Classroom

Answers will vary and must be evaluated to the satisfaction of the instructor.

Assignment Sheet 2—Practice Critical Thinking: Complete a Case Study on Immunity and Infection

Answers will vary and must be evaluated to the satisfaction of the instructor.

